

CLAIMS

What is claimed is:

Claim 1. An apparatus to provide information useful to determine the resistivity of a geological formation from within a cased well, comprising:

a first electrode that electrically engages a first particular section of casing at a specific depth within the well for receiving first signals having voltage related information;

a second electrode that electrically engages the first particular section of casing for receiving second signals having voltage related information located a first distance above said first electrode wherein the magnitude of the resistance of the portion of casing between said first and second electrodes is the first resistance;

a third electrode that electrically engages the first particular section of casing for receiving third signals having voltage related information located a second distance below said first electrode wherein the magnitude of the resistance of the portion of casing between said first and third electrodes is the second resistance;

a fourth electrode that electrically engages the casing at a point located a third distance above said second electrode;

a fifth electrode that electrically engages the casing at a point located a fourth distance above said fourth electrode;

means to conduct a first current from said fourth electrode to said fifth electrode, whereby said fourth distance is chosen such that at least a portion of said first current flows into the formation of interest;

1 means to measure said first resistance and said second  
2 resistance;

3 means for processing said first, second and third  
4 signals from said first, second, and third electrode means  
5 thereby providing information useful to determine the  
6 resistivity of the formation of interest, said means for  
7 processing taking into account a magnitude relating to the  
8 values of said first resistance and said second resistance so  
9 that inaccuracy associated with the determination of the  
10 resistivity is reduced.

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13 Claim 2. A method to provide information useful to  
14 determine the resistivity of a geological formation from  
15 within a cased well, comprising:

16 providing an apparatus having a first electrode that  
17 electrically engages a first particular section of casing for  
18 receiving first voltage related signals at a specific depth  
19 within the well;

20 said apparatus having a second electrode that  
21 electrically engages the first particular section of casing  
22 for receiving second voltage related signals located a first  
23 distance above said first electrode wherein the magnitude of  
24 the resistance of the portion of casing between said first  
25 and second electrodes is the first resistance;

26 said apparatus having a third electrode that  
27 electrically engages the first particular section of casing  
28 for receiving third voltage related signals located a second  
29 distance below said first electrode wherein the magnitude of  
30 the resistance of the portion of casing between said first  
31 and third electrodes is the second resistance;

32 said apparatus having a fourth electrode that  
33 electrically engages the casing at a point located a third  
34 distance above said second electrode;

1        said apparatus having a fifth electrode that  
2 electrically engages the casing at a point located a fourth  
3 distance above said fourth electrode;

4        said apparatus having means to conduct a first current  
5 between said fourth and fifth electrodes, whereby said fourth  
6 distance is chosen such that at least a portion of said first  
7 current flows into the formation of interest; and

8        said apparatus having means to measure said first  
9 resistance and said second resistance;

10       obtaining said first, second, and third voltage related  
11 signals while conducting said first current between said  
12 fourth and fifth electrodes;

13       determining the magnitudes of said first resistance and  
14 said second resistance; and

15       processing the voltage related signals from each of said  
16 first, second, and third electrodes to provide information  
17 useful to determine the resistivity of the geological  
18 formation of interest, said processing taking into account  
19 the determined magnitudes of said first resistance and said  
20 second resistance to reduce the inaccuracy associated with  
21 the determination of the resistivity of the geological  
22 formation of interest.

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24       Claim 3. A method for providing information useful to  
25 determine the resistivity of a geological formation  
26 surrounded by borehole casing comprising the steps of:

27       (a) causing a first current to flow in a first  
28 direction along a predetermined portion of the casing and  
29 measuring a plurality of first voltages across said portion  
30 of the casing;

31       (b) causing a second current to flow in a first  
32 direction along said portion of the casing and measuring  
33 a plurality of second voltages across said portion of the  
34 casing; and

1 (c) using the first and second voltage measurements to  
2 provide information useful to determine the resistivity of a  
3 said geological formation.  
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6 Claim 4. An apparatus for providing information useful  
7 to determine the resistivity of a geological formation  
8 surrounded by borehole casing comprising the following:

9 (a) first means to generate and cause a first current  
10 to flow in a first direction along a predetermined portion of  
11 the casing and second means to measure a plurality of first  
12 voltages across said portion of the casing;

13 (b) third means to generate and cause a second current  
14 to flow in a first direction along said portion of the casing  
15 and fourth means to measure a plurality of second voltages  
16 across said portion of the casing; and

17 (c) processing means using the first and second voltage  
18 measurements to provide information useful to determine the  
19 resistivity of a said geological formation.  
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